UTMUN 2024

Commission on Science and Technology for Development

DIRECTOR
Anne Hu

VICE DIRECTOR
Divvy Gupta

MODERATOR
Ritika Roy Chowdhury

Contents

Equity Disclaimers

Throughout this committee, delegates will be engaging in complex debates and discussions covering a wide array of topics. As UTMUN seeks to provide an enriching educational experience that facilitates understanding of the implications of real-world issues, the content of our committees may involve sensitive or controversial subject matter for the purposes of academia and accuracy. We ask that delegates be respectful, professional, tactful, and diplomatic when engaging with all committee content, representing their assigned country's or character's position in an equitable manner, communicating with staff and other delegates, and responding to opposing viewpoints.

This Background Guide and Commission on Science and Technology for Development (CSTD) for presents topics that may be distressing to some Delegates, including but not limited to the following: Inequality, climate change, Genetically Modified Organisms (GMOs), Biological Research, Stem Cells, and Genetic Screening and Diagnosis of Disorders.

UTMUN recognizes the sensitivity associated with many of our topics, and we encourage you to be aware of and set healthy boundaries that work for you. This may include: preparing yourself before reading this background guide, seeking support after reading the background guide, or filling out the committee switch form beforehand. We ask that all Delegates remain considerate of the boundaries that other Delegates set.

UTMUN expects that all discussions amongst delegates will remain productive and respectful of one another. If you have any equity concerns or need assistance in setting boundaries or navigating sensitive subject matter or have any questions at all, please do not hesitate to reach out to our Chief Equity Officer, Harvi Karatha, at equity@utmun.org. We want you to feel safe and comfortable at UTMUN.

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1. Fill out the UTMUN 2024 Committee Switch Request Form: Committee Switch Request Form

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1. Email equity@utmun.org to reach Harvi Karatha or email deputy.equity@utmun.org to reach Iva Zivaljevic or reach out to me at CSTD@utmun.org.
2. Fill out the (Anonymous if preferred) UTMUN Equity Contact Form: UTMUN Equity Contact Form
3. Notify/Ask any staff member to connect you to Harvi Karatha or Iva Zivaljevic

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The below code of conduct applies to all attendees of UTMUN 2024 for the entire duration of the conference, and any conference-related activities (including but not limited to committee sessions, conference socials, committee breaks, and the opening and closing ceremonies).

1. Harassment and bullying in any form will not be tolerated, the nature of which includes, but is not limited to, discrimination on the basis of race, national origin, ethnicity, colour, religion, sex, age, mental and physical disabilities, socioeconomic status, sexual orientation, gender identity, and gender expression,
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        ii. Nonconsensual sexual contact and/or behaviour between any individuals and/or groups of individuals;
        iii. Sexual contact or behaviour between delegates and staff members is strictly forbidden;

2. UTMUN expects all attendees to conduct themselves in a professional and respectful manner at all times during the conference. Specific expectations, include, but are not limited to,
    a. Attendees must, if able, contribute to the general provision of an inclusive conference and refrain from acting in a manner that restricts other attendees' capacity to learn and thrive in an intellectually stimulating environment;
    b. Attendees must adhere to the dress code, which is Western business attire;
        i. Exceptions may be made on a case-by-case basis depending on the attendees' ability to adhere to the previous sub-clause;
        ii. Attendees are encouraged to contact Chief Equity Officer, Harvi Karatha, at equity@utmun.org with questions or concerns about the dress code or conference accessibility;

c. Attendees must refrain from the use of cultural appropriation to represent their character and/or country, including the use of cultural dress, false accent, and any behaviour that perpetuates a national or personal stereotype;
d. Delegates must not use music, audio recordings, graphics, or any other media at any time unless approved and requested to be shared by the Dais and/or the Chief Equity Officer, Harvi Karatha at equity@utmun.org;
e. Attendees must abide by instructions and/or orders given by conference staff, members;
i. Attendees are exempt from this above sub-clause only if the instructions and/or orders given are unreasonable or inappropriate;

3. Delegates, staff, and all other conference participants are expected to abide by Ontario and Canadian laws and Toronto by-laws, as well as rules and regulations specific to the University of Toronto. This includes, but is not limited to,
a. Attendees, regardless of their age, are strictly prohibited from being under the influence and/or engaging in the consumption of illicit substances, such as alcohol or illicit substances for the duration of the conference;
b. Attendees are prohibited from smoking (cigarettes or e-cigarettes, including vapes) on University of Toronto property;
c. Attendees must refrain from engaging in vandalism and the intentional and/or reckless destruction of any public or private property, including conference spaces, venues, furniture, resources, equipment, and university buildings;
i. Neither UTMUN nor any representatives of UTMUN is responsible for damage inflicted by attendees to property on or off University of Toronto campus;
ii. Individuals will be held responsible for any damages.

4. The Secretariat reserves the right to impose restrictions on delegates and/or attendees for not adhering to/violating any of the above stipulations. Disciplinary measures include, but are not limited to,
a. Suspension from committee, in its entirety or for a specific period of time;
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A Letter From Your Director:

Dear Delegates,

Welcome to the Commission on Science and Technology for Development (CSTD)! My name is Anne Hu, and I will be your director this year. I am a second year student studying Neuroscience, and I am very pleased to have worked on this committee.

In CSTD, we will be examining two topics. First, the usage of artificial intelligence (AI), and second, the usage of biotechnology. My hopes for this committee is that through research and discussion, we will find a way for countries to collaborate on reaching the United Nations' (UN) Sustainable Development Goals (SDGs) through Artificial Intelligence and biotechnology. Along the way, there will be discourse on the topics of regulation, historical usage, future usages and risks, but these conflicts will go towards building better resolution. I look forward to seeing all countries researching, debating, and working together on resolving issues, some issues which haven't even been resolved in the real world yet!

Happy reading, and don't be afraid to reach out to me (CSTD@utmun.org) if there are any lingering questions. I encourage you to email me if you need access to a resource, and I will do my best to help out.

Best Wishes,
Anne Hu

Topic A: Artificial Intelligence

History of AI and the UN

Past UN action may be summarized in the following list:[1]

- The 2018-2019 guiding principles on lethal autonomous weapons systems, in accordance with the Convention on Certain Conventional Weapons, may lead to a prohibition on lethal autonomous weapons without human control.
- The 2021 recommendations on Ethics of Artificial Intelligence, from United Nations Educational, Scientific and Cultural Organization (UNESCO)
- Recommendations on tackling the potential use of AI for terrorist purposes, provided by the Office of Counter-Terror, in conjunction with the Interregional Crime and Justice Research Institute
- The AI for Good Summit hosted by the International Telecommunication Union (ITU) continues to connect experts, the private sector, UN agencies and governments.

Prospective future action, as stated by Gutteres on the Security Council includes:[2]

- Recommendations that the Member States develop national strategies for responsible AI use and development, including in military applications of AI
- Agreement on a global framework for overseeing data-driven technology and AI in counter-terrorism.
- Prohibition of lethal autonomous weapons systems and agreement on the need for human control in nuclear weaponry.

Different bodies, agencies, offices and departments of the UN system have been exploring ways to leverage the potential of AI to drive change and impact across their issue areas. In 2020, the UN System Chief Executives Board for Coordination (CEB) and its High-Level Committee on Programmes (HLCP) established the interagency working group on AI (IAWGAI), co-led by ITU and UNESCO, to bring together UN system expertise on AI in support of the CEB and HLCP workstreams on the ethics of AI (led by UNESCO) and the strategic approach and road map for supporting capacity development (led by ITU), and the related gap analysis effort carried out by ITU, informed by the UN Activities on AI Report, to identify the gaps in UN AI-related activities in order to help the UN system prioritize strategic actions. Since 2021, the IAWG-AI has successfully galvanized expertise from across the UN system as well as external stakeholder groups to advance the responsible development and use of AI in the UN, underpinned by ethics and human rights, while driving forward the 2030 Agenda on Sustainable Development. As part of the IAWG-AI, UNESCO and OICT have led the development of the Principles for the Ethical Use of Artificial Intelligence in the United Nations System, which was based on UNESCO's Ethics of AI Recommendation and endorsed by the HLCP at its 43rd session and the CEB in 2022.[3]

[1] "Secretary-General Urges Security Council to Ensure Transparency, Accountability, Oversight, in First Debate on Artificial Intelligence | UN Press," July 18, 2023, https://press.un.org/en/2023/sgsm21880.doc.htm.
[2] Ibid.
[3] ITU Publications, "United Nations Activities on Artificial Intelligence (AI)," 2022, accessed November 16, 2023, https://www.itu.int/dms_pub/itu-s/opb/gen/S-GEN-UNACT-2022-PDF-E.pdf.

Questions to Consider:

- **How can the CSTD utilize, support and enhance pre-existing organizations/systems, both within the UN and outside of the UN?**
- **What are some ethical uses of AI? What are some non-ethical, high-risk uses of AI?**
- **How can AI usage perpetuate pre-existing inequalities? And how do we combat this?**
- **How may countries collaborate with each other to produce ethical AI technology?**
- **What can the CSTD recommend to members to incentivize Green AI development over Red AI?**
- **Why should AI technology be regulated? What are some different modes of proposed regulation? How do different countries act to regulate the dangers/risks associated with AI? How does your nation attempt to regulate AI, compared to what the UK, China and the EU are doing?**
- **What are some national/local problems being tackled by AI in your delegate nation?**
- **What are some concerns your nation currently holds over AI development, and what can the CSTD do to alleviate or counteract these concerns?**

1.1 - Collaboration with Pre-Existing Entities

The International Telecommunication Union (ITU) is a UN agency with the goal of improving global access to communications technologies.[4] Concerning AI, The ITU collaborates with UNESCO, as UNESCO concerns itself with the ethics of AI, while the ITU helps the UN strategize its actions by identifying a "strategic approach and road map for supporting capacity development" and "the gaps in UN activity". Each year, the ITU publishes a report titled "UN Activities on the topic of AI", maintaining a directory of AI-related projects. the ITU highlights AI deployment, such as where the AI solutions are being utilized, and how the technology is developed. Currently, software tools and reporting is the most common uses of AI in UN projects, used for the purpose of tracking SDG progress (or lack thereof).[5] Many of these projects are collaborative, with two-thirds of UN projects featuring partnerships, whether that be within the UN system, external academia, other international organizations, governments, or private sectors. In general, 85% of these projects are linked to more than one SDG, while interestingly, SDG 3 (Good Health and Wellbeing), 9 (industry, innovation, and infrastructure), 10 (reduced inequalities) and 17 (partnerships for goals) are the 5 most commonly involved SDGs. Increasing in relevance are SDG 13 (climate action) and SDG 16 (Peace, Justice and Strong Institutions). Along with the SDG(s) of interest, many projects focus on human rights, health, environment, and agriculture.[6]

The ITU organizes a global summit in partnership with 40 other UN sister agencies, called AI for Good. In 2022, this platform convened in Switzerland, drawing 260,000 views and involved over 180 countries in its action-oriented, inclusive discussion. AI for Good also launched the Neural Network, a community networking and content platform, intended to connect users with innovators and experts to exact social impact and progression towards the SDGs. Meanwhile, the UN Secretariat's Global Pulse Labs employs a combination of data science, behavioural science, and digital technology and a multi-disciplinary approach to innovating sustainable solutions for the future. UN Global Pulse creates partnerships between governments, UN entities, academia and the private sector to design, develop, and deploy innovations.[7]

In addition to UN entities, organizations such as the Organization for Economic and Co-operation and Development (OECD) maintain records on national AI policy and development through the OECD AI Policy Observatory. Using real-time information, country initiatives can be compared and analyzed, allowing for dialogue to be shared on AI policy progression and impact.[8] The OECD has experts and guest contributors who share their experiences and research on a blog.[9] The organization also provides recommendations for OECD countries to adopt on the topic of trustworthy AI[10] and a framework for classifying AI systems from a policy perspective,[11] in addition to other publications regarding to AI in employment, regulation and computing capacity, the latter of which is outside the scope of this committee.

[4] "About ITU," ITU, n.d., https://www.itu.int/en/about/Pages/default.aspx.
[5] ITU Publications, "United Nations Activities on Artificial Intelligence (AI)."
[6] Ibid.
[7] "UN Global Pulse – Big Data for Development and Humanitarian Action," n.d., https://www.unglobalpulse.org/.
[8] "Artificial Intelligence," OECD, n.d., https://www.oecd.org/digital/artificial-intelligence/.
[9] "The OECD Artificial Intelligence Policy Observatory - OECD.AI," n.d., https://oecd.ai/en/.
[10] "AI-Principles Overview - OECD.AI," n.d. https://oecd.ai/en/ai-principles.
[11] "OECD Framework for the Classification of AI Systems: A Tool for Effective AI Policies - OECD.AI," n.d., https://oecd.ai/en/classification.

There have been some proposed UN sister organizations as well, such as UNOGAI. It is a fictional entity,[12] created for the purposes of proposing a competition like WCAIR for supporting regional-level AI development. It theoretically exists to encourage the proliferation of AI technology, and its derivatives for the good of humanity. The proposed organization differs slightly from AI for Good and the ITU, focussing on funding city-level investments and tracking regional progress on funded projects. This goal is accomplished through the WCAIR, which incites cities to compete in developing AI usages for their own uses, and it is funded through the World Bank.[13] WCAIR and the UNOGAI website have not been updated since 2021. However, it may serve as the basis of any initiatives the committee may want to pursue in terms of goals and approaches.

Case Study: Singapore, the Smart City

Singapore is one such top city in using AI for the betterment of humanity, according to the Institute of Management Development's index. It is a 'smart city' as Singapore "applies technology to enhance benefits and diminish the shortcomings of urbanization for its citizens".[14] The Smart Nation initiative, launched in 2014, has been credited for the introduction of technology into both public and private sectors, leveraging technology for improvements to citizens' quality of life. Many experiences have been transformed by the use of technology, including but not limited to transportation optimization, the digitization of healthcare, and the proliferation of AI education to students and proliferation.[15]

[12] "UN Office for Global Artificial Intelligence (UNOGAI) – 'Omni Possibile Exigit Existere,'" n.d., https://unogai.org/.
[13] Editor, "United Nations Office for Global Artificial Intelligence Announces 2021 World AI City Rankings Competition – UN Office for Global Artificial Intelligence (UNOGAI)," August 1, 2021, https://unogai.org/unogai-news/united-nations-office-for-global-artificial-intelligence-announces-2021-world-ai-city-rankings-competition/.
[14] The Straits Times, "Singapore Is World's Smartest City for the Third Year: IMD Smart City Index," EDB: Singapore, November 2, 2021, https://www.edb.gov.sg/en/business-insights/insights/singapore-is-world-s-smartest-city-for-the-third-year-imd-smart-city-index.html.
[15] "Singapore: The World's Smartest City," Thales Group, February 20, 2023, https://www.thalesgroup.com/en/worldwide-digital-identity-and-security/iot/magazine/singapore-worlds-smartest-city.

1.2 - AI in Human Employment

The first of the three, however, is well within the scope of the CSTD's discussion. The OECD carefully monitors the market's response to technological trends, globalization, and population ageing. The OECD urges action to be taken regarding AI as a force within the market, in the form of policy promoting the usage of AI for beneficial results while addressing risks. This recommendation is supported by their 2023 survey reporting. While the number of people employed has stabilized to higher than pre-COVID levels in OECD countries, real wages are lower, partially as a result of high inflation. Secondly, while AI adoption remains fairly low, 27% of jobs are in occupations classified at high risk of automation. Third, seven surveyed employers and employees from OECD countries revealed that AI use in work may lead to positive benefits in the form of job satisfaction, better health and wages.[16] Literature also shows the benefits of AI algorithmic deployment in more optimized urban planning and more environmentally sustainable entrepreneurial resource allotment.[17]

The rise of AI is documented to have three, arguably interconnected, challenges: limited productivity gains, worsening inequalities, and rising ecological costs.[18] At the current trajectory of AI development, some predict that this "AI trilemma" will only worsen, unless specific policy interventions and institutional changes shape AI development towards a more sustainable paradigm. AI firms, as well as organizational leaders in the field, have proposed a development moratorium to allow regulatory bodies to "catch up" with the blazing speed of the field.[19] Evidently, there are some concerns shared by experts, but the average layman also holds concerns of replacement by automation in their professions.

[16] OECD, "EMPLOYMENT OUTLOOK 2023: Artificial Intelligence and Jobs," 2023, https://www.oecd.org/employment-outlook/2023/.
[17] Tim Heinrich Son et al., "Algorithmic Urban Planning for Smart and Sustainable Development: Systematic Review of the Literature," Sustainable Cities and Society 94 (July 1, 2023): 104562, https://doi.org/10.1016/j.scs.2023.104562.
[18] Ekkehard Ernst, "The AI Trilemma: Saving the Planet without Ruining Our Jobs," Frontiers in Artificial Intelligence 5 (October 19, 2022), https://doi.org/10.3389/frai.2022.886561.
[19] Cade Metz and Gregory Schmidt, "Elon Musk and Others Call for Pause on A.I., Citing 'Risks to Society,'" The New York Times, March 29, 2023, https://www.nytimes.com/2023/03/29/technology/ai-artificial-intelligence-musk-risks.html.

In employment, there have been studies conducted on the relationship between productivity, AI usage, worker employment, and sustainable development. For some industries such as customer service, customers tend to prefer human interactions, although AI is more cost effective.[20] In an analysis of wages versus AI, innovations in software and robots are associated with wage decreases, whilst AI exposure and innovations in AI specifically correlate with increases in productivity and wage increases. These results would suggest a displacement effect of innovations in software and industrial robots, whilst AI innovations tend to create different demands for services.[21] Using urban planning as an example, it was found that the convergence of artificial and human intelligence is necessary for sustainable development, involving collaboration between big data, smart cities and algorithmic urban planning.[22] In one application, the MIT Algorithmic Zoning project's first project tackled the lack of affordable housing in downtown areas. Using Agent-Based Modelling, the behaviour of people in reaction to certain adaptive zoning policies was analyzed, allowing for predicted effects of implementing housing incentives or disrupting an urban environment.[23]

With concerns also comes benefits. The education system and the healthcare system are two case studies where AI implementation could result in great benefits, great losses, or a mix of both.

Case Study: The Education System

In 2023, UNESCO published guidance for the use of generative AI in education and research.[24] This document was the first guidance from UNESCO on the topic of generative AI in education, and it was intended to support country implementation through policy recommendations and humanitarian considerations.[25] AI presents a wondrous opportunity to optimize and disrupt current teaching/learning practices, and accelerate progress towards SDG 4, but the technology is not without controversy. Generative AI does not understand the real world, its contents may propagate lies through "hallucinations," and the technology continues to reproduce what has already been done, representing equity concerns and possibly repressing any new content produced by humanity.[26] In short, UNESCO encourages to adoption of AI with the appropriate regulations, encouraging a human centric approach. Build the capacity to utilize artificial intelligence, define what is illegal so that punishment is possible, educate on the risks of generative AI, control the risks of data poverty, and tend towards ethical uses.

[20] Catherine Prentice and Tuyet-Mai Nguyen, "Engaging and Retaining Customers with AI and Employee Service," Journal of Retailing and Consumer Services 56 (September 1, 2020): 102186, https://doi.org/10.1016/j.jretconser.2020.102186.
[21] Frank M. Fossen, Daniel Samaan, and Alina Sorgner, "How Are Patented AI, Software and Robot Technologies Related to Wage Changes in the United States?," Frontiers in Artificial Intelligence 5 (June 14, 2022), https://doi.org/10.3389/frai.2022.869282.
[22] Tim Heinrich Son et al., "Algorithmic Urban Planning for Smart and Sustainable Development: Systematic Review of the Literature," Sustainable Cities and Society 94 (July 1, 2023): 104562, https://doi.org/10.1016/j.scs.2023.104562.
[23] "Project Overview < Algorithmic Zoning – MIT Media Lab," MIT Media Lab, n.d., https://www.media.mit.edu/projects/algorithmic-zoning-dynamic-urban-planning/overview/.
[24] "Artificial Intelligence in Education," UNESCO, November 29, 2023, https://www.unesco.org/en/digital-education/artificial-intelligence.
[25] Ibid.
[26] Ibid.

The potential positive changes that AI may bring to education are wondrous. First, AI can increase global accessibility to classroom activities through translation software. The automation of tasks can decrease the amount of time a teacher spends creating and grading assessments, and increase the amount of time a teacher can assist individuals or groups of students. AI can also provide support outside of the classroom, as long as the user is aware of AI's fallacies.[27] This external supports is an opportunity for individualized learning, potentially allowing for a customized curriculum, a contrast to many learning environments now with larger classroom sizes. It would seem that at a classroom level, AI serves to supplement learning, more-so than a replacement for a teaching figure. After all, if AI were to teach, it would be limited to the methods that have been conducted before, presenting the potential for propagating misinformation without correction.

Case Study: The Healthcare System

As the global population increases and ages, an increasing strain is placed on the healthcare system. The consequences of this effect are extremely consequential on those who require medical care. Technology can be used to explore new opportunities for assisting those who require care.

In a 2018 symposium on ethics and AI, it was highlighted that disobedient AI is not the biggest concern in healthcare, but obedient AI applied in a haphazard or lazy manner. The misuse of artificial intelligence in healthcare risks the erosion of public trust in the healthcare setting. Another highlighted problem was representative data to guide decision making.[28] For example, a model trained on one data source may not correctly interpolate for a different population. Additionally, extrapolations are very difficult, AI struggles to work outside of the training set of data. Digital inequality is another concern, as countries differ in ability to collect, utilize, and regulate data. Additionally, the parameters for a healthcare decision treads into very murky ground. AI may make the decision to extend a patient's life, but at a lower quality. Alternatively, AI may decide that ending a patient's life is more favourable, depending on weights assigned to input values.[29] These values are decided upon by the creator of the AI model, thus, there is some attribution of responsibility that AI technology can or cannot take on - this point of liability is still debated.

[27] Bernard Marr, "How Is AI Used in Education — Real World Examples of Today and a Peek into the Future," Bernard Marr, July 13, 2021, https://bernardmarr.com/how-is-ai-used-in-education-real-world-examples-of-today-and-a-peek-into-the-future/.
[28] "Ethics and AI for Good Health: Symposium Report" (University of Toronto Joint Center for Bioethics, 2017), https://jcb.utoronto.ca/wp-content/uploads/2021/03/Ethics-and-AI-for-Good-Health_Symposium-Report.pdf.
[29] Ibid.

A final consideration is data infrastructure. A lack of data infrastructure for the purposes of data collection leads to a lack of data in training a model, decreasing representation and suitability for use within a population. To combat potential bias in training data, it is recommended to build on generalized data infrastructure like the Science and Technology Research Infrastructure or Discovery, Experimentation and Sustainability (STRIDES) from NIH or MIMIC from MIT Laboratory for Computation Physiology.[30] From a regulatory standpoint, it would be beneficial for governments to mandate that all healthcare organizations must store clinical data on commercially available cloud storage, in an electronic format. For example, Observational Medical Outcomes Partnership (OMOP) and Fast Healthcare Interoperability resources (FHIR) are currently existing initiatives.[31] Naturally, informed consent must be obtained for the collection of this information, and gaps in information will still persist when patients opt-out. Additionally, individual data must be blinded so that no patients can be identified - this presents difficulties in rare diseases, or in unique cases.[32]

One undisputed application of AI in healthcare was throughout the COVID-19 pandemic. Throughout the pandemic, machine learning was used to predict disease outcomes in patients and tracking the disease spread through computational medicine. Medical imaging was processed by machine learning and a prediction could be made on whether or not the patient was infected with COVID-19.[33] In this application, the AI achieved high efficiency, demonstrating the potential to enhance existing medical and healthcare systems.[34]

A final note: the technology that drives healthcare will also likely incorporate AI at some timepoint. The reason is simply related to the quantity of data produced and collected. In research, AI utilizes machine learning and Big Data analytics to discover knowledge and mine data for significant correlations. Natural language processing can be used to process past knowledge to better inform future decisions.[35] It appears that to better medicine, as well as the wider sphere of research, methods involving artificial intelligence will be an unavoidable necessity for assisting the process. With increased efficiency, the research process may be accelerated through AI use, increasing progression towards fulfilling SDGs.

[30] Trishan Panch, Heather Mattie, and Leo Anthony Celi, "The 'Inconvenient Truth' about AI in Healthcare," Npj Digital Medicine 2, no. 1 (August 16, 2019), https://doi.org/10.1038/s41746-019-0155-4.
[31] Ibid.
[32] Ibid.
[33] Khaled H. Almotairi et al., "Impact of Artificial Intelligence on COVID-19 Pandemic: A Survey of Image Processing, Tracking of Disease, Prediction of Outcomes, and Computational Medicine," Big Data and Cognitive Computing 7, no. 1 (January 11, 2023): 11, https://doi.org/10.3390/bdcc7010011.
[34] Ibid.
[35] Andreas Holzinger et al., "AI for Life: Trends in Artificial Intelligence for Biotechnology," New Biotechnology 74 (May 1, 2023): 16–24, https://doi.org/10.1016/j.nbt.2023.02.001.

1.3 - Environmental Impact of AI

Before AI deployment, AI must be developed. The process of AI development includes the creation of an initial model, followed by a training process. This process is where AI has the most negative impact, as energy is required in large amounts for computing power, followed by the deployment of the AI after development, which also requires power to utilize. For example, the training of a natural language processing model is the CO2 emissions equivalent of 125 round trips between New York and Beijing. MIT estimates that the cloud industry has the equivalent carbon footprint of the global airline industry.[36]

Estimating the environmental impacts of AI training is also problematic, as there is little information available on the training process itself. Factors such as the location of the training server, the energy mix of the energy grid the server is located on, the length of the training, and the hardware used to host the training all may increase or decrease the carbon impact of AI models.[37] To accurately gauge the environmental impacts of different AI models, it is recommended that parties developing AI increase transparency in sharing energy usage data, and data related to global server locations.

These concerns become increasingly magnified as competition for better AI continues. As recognized in literature, "For a linear gain in performance, an exponentially larger model is required, which can come in the form of increasing the amount of training data or the number of experiments, thus escalating computational costs, and therefore carbon emissions."[38] To counteract these concerns, it is recommended that researchers prioritize efficient hardware, value efficient models in addition to accurate models, and also report factors required to assess environmental impact. However, it also must be recognized that inefficient models may still be important, pushing the limits and leading to better and more efficient downstream technological improvements, saving time and energy in the long run. The implementation of 'Green AI Principles' as a standard has been recommended, allowing for levels of certification according to environmentally beneficial practices, within both the sphere of AI development and AI deployment. Present-day, some tools already exist for assessing environmental impact. For example, tools like Microsoft Cloud for Sustainability help companies track their environmental, social and governance footprint,[39] and the Machine Learning Emission Calculator helps estimate impact based on location and computer hardware.[40] Google also has identified 4 best practices for reducing energy/carbon emissions for users of Google's Cloud services. These practices include: efficient models, optimized processors, usage of Cloud computing, and emphasis on locations with green capacity.[41] For the latter two practices, certain locations like Montreal, Canada, hosts data centers on entirely green energy sources, namely hydroelectricity.[42]

[36] Bernard Marr, "Green Intelligence: Why Data And AI Must Become More Sustainable," Forbes, March 22, 2023, https://www.forbes.com/sites/bernardmarr/2023/03/22/green-intelligence-why-data-and-ai-must-become-more-sustainable/?sh=4edeb4567658.
[37] Payal Dhar, "The Carbon Impact of Artificial Intelligence," Nature Machine Intelligence 2, no. 8 (August 12, 2020): 423–25, https://doi.org/10.1038/s42256-020-0219-9.
[38] Roy Schwartz et al., "Green AI," arXiv, August 13, 2019, 1, https://arxiv.org/pdf/1907.10597.pdf.
[39] "Microsoft Cloud for Sustainability," Microsoft, n.d., https://www.microsoft.com/en-us/sustainability/cloud.
[40] "Machine Learning CO2 Impact Calculator," n.d., https://mlco2.github.io/impact/#compute.
[41] "Good News about the Carbon Footprint of Machine Learning Training," February 15, 2022, https://blog.research.google/2022/02/good-news-about-carbon-footprint-of.html.
[42] Marr, "Green Intelligence: Why Data And AI Must Become More Sustainable."

AI has the potential to mitigate climate change as well, by improving energy efficiency. Smart manufacturing, smart energy grids, and intelligent transport systems can significantly reduce energy consumption, waste and carbon emissions globally. Utilization of AI-enhanced monitoring systems allows for better accuracy in forecasting, such as with weather.[43] The United Nations Environmental Programme (UNEP) has many applications of AI monitoring for the management of large quantities of climate data. For example, the UNEP's World Environmental Situation Room (WESR) accesses, analyzes and visualizes observational data and sensor data to predict factors such as CO2 atmospheric concentration, changes in glacier mass, and sea level rise. Within the WESR, there is the International Methane Emission Observatory (IMEO), a platform specializing in collecting and verifying methane measurements across the globe. The UNEP also cooperates with IQAir, producing the GEMS Air Pollution Monitoring platform, an information network which collects data and informs insights on air quality in real-time. Lastly, the UNEP does acknowledge the environmental costs to improve environmental monitoring. The "CODES Action Plan for a Sustainable Planet in the Digital Age", an initiative originating from the UN Secretary General's "Roadmap for Digital Cooperation" attempts to reduce the footprint of the information and communication technologies sector.[44]

[43] Lin Chen et al., "Artificial Intelligence-Based Solutions for Climate Change: A Review," Environmental Chemistry Letters 21, no. 5 (June 13, 2023): 2525–57, https://doi.org/10.1007/s10311-023-01617-y.
[44] United Nations Environment Programme, "How Artificial Intelligence Is Helping Tackle Environmental Challenges," UNEP, n.d., https://www.unep.org/news-and-stories/story/how-artificial-intelligence-helping-tackle-environmental-challenges.

1.4 - Global Regulation Guidelines for AI

On July 18th, 2023, UN Secretary-General Antonio Guterres remarked to the Security Council on the topic of AI, specifically generative AI. Estimating contributions between $10 and 15 trillion to the global economy by 2030, AI has great potential for monitoring the environment and supercharging medical research breakthroughs. However, the potential for AI tools to disturb peace and security was also highlighted. The generation of hate speech and disinformation holds the potential to manipulate facts, contributing to societal polarization. Deepfakes may further be used to undermine credibility. Not limited to generative AI, AI-enabled systems like social media also create security risks by allowing the spread of false theories and inciting violence. Guterres remarked finally on the risk of malfunctioning AI, given the emergence of AI systems in nuclear weaponry, biotechnology, neurotechnology, and robotics. In light of the apparent global threats, Guterres calls for a universal approach to AI governance, likening the situation to the emergence of nuclear weaponry. As a result, Gutteres recommends the creation of a new UN entity to govern AI technology, a global watchdog of sorts, similar to the International Atomic Energy Agency (IEAE), the International Civil Aviation Organization (ICAO), or the Intergovernmental Panel on Climate Change.[45]

Outside of the Security Council, the United Nations Ofiice of the High Commissioner for Human Rights (UNHCHR) outlines two current stances on regulation, with the goal of limiting risks while reaping the benefits of AI. First, there is risk-based regulation, the favoured method of the European Union (EU). Responsibility is attributed to the private sector and the AI developers to self-regulate and self-assess tools. This approach is often criticized for leaving gaps in regulation. The other approach, recommended by the UNHCHR, includes consideration for human rights in the life cycle of AI, from the collection, selection and processing of data, to the design and deployment of the models, tools and services. This approach highlights the people who are affected by AI, including those who are disproportionately affected by biases in AI. For one, potential abuses of power and privacy intrusions are also greatly considered in this approach, especially within AI use in sensitive private/public services, like justice, migration, social protection or financial services. Secondarily, continual assessment of these AI systems will be required. There is a need for transparency guarantees and independent oversight. To supplement the oversight, additional expansion of pre-existing regulations in data protection, competition law, and sector-specific regulations in healthcare, technology and finance is required.[46]

[45] United Nations Environment Programme, "How Artificial Intelligence Is Helping Tackle Environmental Challenges," UNEP, n.d., https://www.unep.org/news-and-stories/story/how-artificial-intelligence-helping-tackle-environmental-challenges.
[46] "Artificial Intelligence Must Be Grounded in Human Rights, Says High Commissioner," United Nations Office of the High Commissioner Human Rights, July 12, 2023, https://www.ohchr.org/en/statements/2023/07/artificial-intelligence-must-be-grounded-human-rights-says-high-commissioner.

Case Study: EU Vs USA Approach to AI Regulation

Currently, the US and the EU both employ risk-based approaches to AI regulation, and share similar criteria for how "trustworthy AI" should function. This criteria includes the broad encouragement of robustness, safeness, non-discrimination, security, transparency and accountability. Both approaches anticipate the role of standards organizations to determine and enforce regulations. The methods begin to differ in how to achieve these goals for AI use. The EU approaches the endeavour with a centrally coordinated and comprehensive coverage methodology, inclusive of more applications and restricting more stringently on each application. The EU regulator currently has regulatory power, investigatory powers, and the ability to fine entities for non-compliance. The EU method is complex, building on both pre-existing legislation like the General Data Protection Regulation, and creating new legislation, like the Digital Services Act or Digital Markets Act. Some legislation like the AI Act are currently being debated. The AI Act attempts to classify AI use applications and administer regulations depending on the level of risk. Some applications, like deepfakes, chatbots, or biometric analysis are high-risk, requiring disclosure when used. Other risks are deemed unacceptable and would be banned completely, in the case of AI for social scoring, AI-enabled manipulative technology, and biometric identification by law enforcement in public spaces.

The US approach allows each governmental agency to create its own guidelines for AI application within the agency's domain, with no clear method of enforcement. Currently, litigation appears to be the only legal authority to regulate algorithms, as agencies do not have clear legal authority to punish transgressions.[47] However, despite the sector-specific and vague regulatory directive, many federal agencies have not developed plans as of December 2022, only 5/41 governmental agencies had a plan, with only one major agency developing a comprehensive plan in response to AI use.[48]

Globally, it is predicted that AI in other nations will follow the EU's regulatory lead as a result of the "Brussels' Effect". This phenomenon highlights the influence of the EU, evident in product safety regulations. Through market forces, trade partners of the EU will adopt the EU's more stringent guidelines for entry into the EU commercial market, eventually transitioning the EU standard into a global standard.[49]

[47] "The EU and U.S. Diverge on AI Regulation: A Transatlantic Comparison and Steps to Alignment | Brookings," Brookings, June 24, 2023, https://www.brookings.edu/articles/the-eu-and-us-diverge-on-ai-regulation-a-transatlantic-comparison-and-steps-to-alignment/.
[48] Christie Lawrence, Issac Cui, and Daniel Ho, "Implementation Challenges to Three Pillars of America's AI Strategy," December 2022, https://hai.stanford.edu/sites/default/files/2022-12/HAIRegLab%20White%20Paper%20-%20Implementation%20Challenges%20to%20Three%20Pillars%20of%20America%E2%80%99s%20AI%20Strategy.pdf.
[49] Anu Bradford, The Brussels Effect, Oxford University Press eBooks, 2019, https://doi.org/10.1093/oso/9780190088583.001.0001.

Case Study: The Chinese Approach to AI Regulation

In 2021, China enacted some of the world's first binding national regulatory guidelines on AI. There are currently three documents on algorithms and deep AI, created with the goal of controlling information: 2021 regulation on recommendation algorithms, 2022 rules for deep synthesis, and 2023 draft rules on generative AI. These regulations requires developers to file with China's algorithm registry, a new government repository which stores information on algorithm training and requires a security assessment before usage. The registry serves as a tool in regulatory scaffolding, for future regulations. Additionally, China also has local regulations, such as ones that cover autonomous vehicles, and some policy documents that stimulate the AI industry. The uniqueness of China's approach to AI lies in the speed and rationale for the creation of such regulation. For example, the term "deep synthesis" was coined by the Chinese company Tencent to describe the synthetic generation of content, in order to replace the more politically problematic term "deepfakes". This term was eventually used in the final regulatory document. Interestingly, this regulatory document concerning deep synthesis regulation also included the use of algorithms. It includes some censorship requirements and explicit restrictions on fake news generation. Deep synthesis content must also be labelled, with the users' names displayed, and the content must have the consent of the people used in the content.

The next large law to be passed is the Artificial Intelligence Law, currently scheduled for enactment in the 2023 legislative year. The document, "Generative AI Measure" or The Provisional Administrative Measures of Generative Artificial Intelligence Services. The document outlines requirements and obligations that AI service providers must abide by.[50] Of global relevance, China is one of the largest producers of AI research, and US-Chinese AI systems increasingly interact with each other in global markets.[51]

[50] Anna Gamvros, "China Finalises Its Generative AI Regulation | Data Protection Report," Data Protection Report, July 26, 2023, https://www.dataprotectionreport.com/2023/07/china-finalises-its-generative-ai-regulation/.
[51] Matt Sheehan, "China's AI Regulations and How They Get Made," Carnegie Endowment for International Peace, July 10, 2023, https://carnegieendowment.org/2023/07/10/china-s-ai-regulations-and-how-they-get-made-pub-90117.

Other Resources for Topic A

- UNCTAD. “26th CSTD Side Event: Panel Discussion on Protecting Information Integrity in the Age of Artificial Intelligence (AI),” n.d. https://unctad.org/meeting/26th-cstd-side-event-panel-discussion-protecting-information-integrity-age-artificial.

- UNCTAD. “26th CSTD Side Event: Panel Discussion on Protecting Information Integrity in the Age of Artificial Intelligence (AI),” n.d. https://unctad.org/meeting/26th-cstd-side-event-panel-discussion-protecting-information-integrity-age-artificial.

- UNESCO. “Artificial Intelligence in Education,” October 16, 2023. https://www.unesco.org/en/digital-education/artificial-intelligence.
- “Ethics and AI for Good Health: Symposium Report.” University of Toronto Joint Center for Bioethics, 2017. https://jcb.utoronto.ca/wp-content/uploads/2021/03/Ethics-and-AI-for-Good-Health_Symposium-Report.pdf.
- Fournier-Tombs, Eléonore. “Towards a United Nations Internal Regulation for Artificial Intelligence.” Big Data & Society 8, no. 2 (July 1, 2021): 205395172110394. https://doi.org/10.1177/20539517211039493.
- Hacker, Philipp, A. Engel, and Marco Mauer. “Regulating ChatGPT and Other Large Generative AI Models.” ACM Digital Library v (June 12, 2023). https://doi.org/10.1145/3593013.3594067.
- Holzinger, Andreas, Katharina Keiblinger, Petr Holub, Kurt Zatloukal, and Heimo Müller. “AI for Life: Trends in Artificial Intelligence for Biotechnology.” New Biotechnology 74 (May 1, 2023): 16–24. https://doi.org/10.1016/j.nbt.2023.02.001.
- United Nations System. “Principles for the Ethical Use of Artificial Intelligence in the United Nations System,” September 9, 2022. https://unsceb.org/sites/default/files/2022-09/Principles%20for%20the%20Ethical%20Use%20of%20AI%20in%20the%20UN%20System_1.pdf.
- Reporter, Guardian Staff. “Africa Will Be Transformed by the Potential of AI and Data – If We Can Get Investment.” The Guardian, June 1, 2023. https://www.theguardian.com/commentisfree/2023/jun/01/africa-will-be-transformed-by-the-potential-of-ai-and-data-if-we-can-get-investment.
- “The OECD Artificial Intelligence Policy Observatory - OECD.AI,” n.d. https://oecd.ai/en/.
- “UN Boss Recommends Nuclear Option for AI Regulation • The Register Forums,” June 14, 2023. https://forums.theregister.com/forum/all/2023/06/14/un_ai_regulation/.
- United Nations Environment Programme. “How Artificial Intelligence Is Helping Tackle Environmental Challenges.” UNEP, n.d. https://www.unep.org/news-and-stories/story/how-artificial-intelligence-helping-tackle-environmental-challenges.

Topic B: Using Biotechnology to Promote Sustainable Development

Biotechnology involves the manipulation of cellular and biomolecular processes of the cell, for the purposes of developing technology.[52] Cells are the foundation of life in plants, animals, and other forms of life. The Commission for Sustainable Development desired to enhance the contribution of biotechnology in sustainable development, encouraging greater economic, environmental, ethical and health proposals at the national and international level.[53] In 2005, biotechnology was identified to have potential to make great strides in healthcare and food security. However historically, due to concerns of biosafety and commercialization of biotechnology products, a more cautionary approach was taken, with the establishment of the Biosafety Information Network and Advisory Service under UNIDO. The EU and OECD also have separate regulations for biotechnology, with no globally harmonized framework for the safe handling of biotechnology.[54] Overall, the Commission for Sustainable Development encourages:

- The involvement of business and industry, as well as the incorporation of financial/academic/research institutions to consult on biotechnology development trends and regional/national/international usage,
- The assessment of environmental safety on a case by case basis,
- The support of biotechnology associations, especially in developing countries, to facilitate safe commercialization,
- The strengthening of research facilities with endorsement of biosafety,
- The mobilization of financial resources from public and private companies for biotechnology development and deployment in sustainable use and management,
- The development of integration procedures, emphasizing safety and sustainability.[55]

Biotechnology applies to a range of industries, from medicine, to agriculture, to manufacturing industries, to the computation of datasets.[56] These applications are of special interest to fulfilling the Sustainable Development Goals, striving towards a better future. Despite the momentous potential for biotechnological breakthroughs, there is a time gap in when a solution is developed, and when it can impact an issue. Conversely, some technologies exist on the outskirts of present law, operating in a grey zone of legality.

[52] "What Is Biotechnology? | BIO," n.d., https://www.bio.org/what-biotechnology.
[53] "United Nations Division for Sustainable Development - Sustainable Development Issues - Biotechnology - Decisions of the GA and CSD," n.d., https://www.un.org/esa/sustdev/sdissues/biotechnology/biot_decisions.htm.
[54] "United Nations Division for Sustainable Development- Sustainable Development Issues - Biotechnology," n.d., https://www.un.org/esa/sustdev/sdissues/biotechnology/biot.htm.
[55] "United Nations Division for Sustainable Development - Sustainable Development Issues - Biotechnology - Decisions of the GA and CSD."
[56] Wikipedia contributors, "Biotechnology," Wikipedia, October 20, 2023, https://en.wikipedia.org/wiki/Biotechnology.

With the impact of the coronavirus on all facets of society, the UN has recognized the crippling effect on progress towards the SDGs. Of the 140 targets laid out in the 2030 Agenda for Sustainable Development, 12% are advancing, whilst 30% have not advanced, or have regressed. However, investment in innovations can tackle global challenges. It is known that throughout the pandemic, technology progressed rapidly to deliver diagnostic tests, vaccines, and therapeutic treatments.[57] To survive, the effective usage of biotechnology's products will be necessary. Research is a long, cost-intensive process, fraught with many inequities between the Global North and South. However, even once developed, the implementation remains a challenge, with the balancing of risks and reward, weighing the knowns and potential unknowns that may exist with a technology. It is up to policy-makers to develop a framework for the effective implementation of biotechnology, acknowledging stakeholders and valuing sustainability.

Questions to Consider:

- What are some challenges faced by developing countries in science and technology development? How can industrialized nations assist developing nations with advancing research and supporting the deployment of helpful innovations?
- What are some methods in which to influence action, beyond recommendations?
- How does public safety interact with scientific discovery?
- What niche industries does your delegation specialize within, if any? If not, what are some opportunities (ie. national issues) to develop a solution?
- Who should bear the burden of funding research?
- What initiatives can the CSTD enact to restore public confidence in science and technology, with other parties profiting off of health misinformation?
- How can your delegation and respective countries strive to focus on hitting the 2030 Agenda for Sustainable Development targets? Which targets, if achieved, would immensely benefit your country?

[52] "What Is Biotechnology? | BIO," n.d., https://www.bio.org/what-biotechnology.
[53] "United Nations Division for Sustainable Development - Sustainable Development Issues - Biotechnology - Decisions of the GA and CSD," n.d., https://www.un.org/esa/sustdev/sdissues/biotechnology/biot_decisions.htm.
[54] "United Nations Division for Sustainable Development- Sustainable Development Issues - Biotechnology," n.d., https://www.un.org/esa/sustdev/sdissues/biotechnology/biot.htm.
[55] "United Nations Division for Sustainable Development - Sustainable Development Issues - Biotechnology - Decisions of the GA and CSD."
[56] Wikipedia contributors, "Biotechnology," Wikipedia, October 20, 2023, https://en.wikipedia.org/wiki/Biotechnology.
[57] "As Multiple Crises Threaten Sustainable Development Goals, Sharing Science, Technology Key for Global Progress, Speakers Say as Economic and Social Council Forum Opens | UN Press," May 3, 2023, https://press.un.org/en/2023/ecosoc7125.doc.htm.

2.1- Biotechnology Research Exchange

The world has undergone immense change within the last century, with some countries lagging behind. As more and more technology solutions develop, implementation of these solutions rises to the utmost importance: proper utilization of technologies where needed. It is asked, how do we harness the power of technology to accelerate Least Developed Countries (LDCs) towards economic growth, and in the future, towards the fulfillment of the SDGs. One answer is through the United Nations, an organization capable of assembling global talent towards high-priority goals. For one, the Biotechnology Research Exchange promotes networking and capital development amongst scientists in the field of biomedicine, biotechnology and agriculture. It is organized by the United Nations Technology Bank for the Least Developed Countries (LDC), in collaboration with the International Center for Genetic Engineering and Biotechnology, as well as the World Academy of Sciences. The organization provides training in biotechnology policy and regulation in the form of eLearning modules and hybrid workshops.[58] On a wider level, the UN Technology Bank for LDC does other work attempting to connect LCD to science, technology and innovation needs with available resources, targeting SDGs involving climate, skills development, and economic development.[59]

The Technology Bank also published a report detailing the role of supporting LDCs in the face of rapid global development in order to reach SDGs. There are systemic challenges which prevent LDCs from participating strongly in the goals' completion, such as inequality, persistent poverty, accelerated urbanization, malnutrition, governance issues, poor infrastructure and slow capital accumulation.[60] Most relevant to STI, infrastructural improvements and increased capital accumulation are the most direct interventions within the scope of the CSTD, through programmes such as the Biotechnology Research Exchange.

Different organizations have smaller efforts to assist scientists across the world. The OECD also has an online platform for individuals to implement policies and systems that create more effective working partnerships called the Development Co-operation TIPs: Tools Insights Practices. This tool is mostly policy-focussed in nature, helping OECD countries understand standards and application, as well as examples of responses to development challenges.[61] Oxford University Press has a program that provides access to publications at a free or reduced rate. These initiatives include the EIFL, Research4Life and the Oxford Developing Countries Program.[62]

[58] "Biotechnology Research Exchange and Policy Training | Technology Bank for the Least Developed Countries," n.d., https://www.un.org/technologybank/biotechnology.
[59] "What We Do | Technology Bank for the Least Developed Countries," n.d., https://www.un.org/technologybank/what-we-do.
[60] United Nations Industrial Development Organization, "Propelling LDCs in the Digital Age: A 4IR Perspective for Sustainable Development," 2019, https://www.un.org/technologybank/sites/www.un.org.technologybank/files/4ir_ldc_v_1.20-single_page_version.pdf.
[61] "Development Co-Operation TIPs Tools Insights Practices," OECD, n.d., https://www.oecd.org/development-cooperation-learning/.
[62] "Developing Countries Initiative," Oxford Academic, n.d., https://academic.oup.com/pages/purchasing/developing-countries-initiative.

2.2 - Nanotechnology

One innovation from the last 50 years is nanotechnology. Nanotechnology is the "study, design, creation, synthesis, manipulation, and application of functional materials, devices, and systems through control of matter at the nanometer scale".[63] At the atomic and molecular scale, scientists can exploit special phenomena and properties of matter, developing new technology or improving old technology. Nano-tech has been in development for 50 years, and it is present in almost every field of science, from engineering to biology to communications.[64] It is especially positioned to be a disruptive change in these industries, providing "immediate answers and solutions to help our society, environment and the planet". For example, the mRNA COVID-19 vaccine utilized lipid nanoparticles.[65]

The Japanese government conceptualized "Society 5.0", an economically developed and human-centered society that resolves social issues with the integration of the cyber world into the physical world.[66] The idea is that knowledge and information is shared, with innovation in technology resolving issues such as an aging population, food insecurity, and energy shortages. For example, with a longer life expectancy, the social cost of medical care is expected to increase, since more money is diverted to the medical system from taxpayer money, and more workers are required to support the aging population. However, with preventative medical monitoring and nursing robots, it may be possible to reduce the cost of medical care. Then, in food production and supply chain management, efficiency can be increased through automation and optimization of management.[67] These aims are reminiscent of SDG 1 and 2, No Poverty and Zero Hunger respectively, showing one possible method of integrating technology in social progress.

Within this vision for the future, nanotechnology and its materials are integral to the manufacturing of many devices. Sensors, smart robots and biomaterials all require some form of nanotechnology. There are also many challenges that nanotechnology can face, such as AI chips/quantum devices in computing, transportation with high safety and low environmental impact, nanobiotechnology for health and medical care, service robots, smart materials that are sustainable, and energy materials in renewable energy production/conservation.[68]

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[63] Fabio Salamanca-Buentello et al., "Nanotechnology and the Developing World," PLOS Medicine 2, no. 5 (May 12, 2005): e97, https://doi.org/10.1371/journal.pmed.0020097.
[64] Cherie R. Kagan et al., "Nano Day: Celebrating the next Decade of Nanoscience and Nanotechnology," ACS Nano 10, no. 10 (October 7, 2016): 9093–9103, https://doi.org/10.1021/acsnano.6b06655.
[65] Lisa A. Pokrajac et al., "Nanotechnology for a Sustainable Future: Addressing Global Challenges with the International Network4Sustainable Nanotechnology," ACS Nano 15, no. 12 (December 15, 2021): 18608–23, https://doi.org/10.1021/acsnano.1c10919.
[66] "Society 5.0," Cabinet Office Home Page, n.d., https://www8.cao.go.jp/cstp/english/society5_0/index.html.
[67] Pokrajac et al., "Nanotechnology for a Sustainable Future: Addressing Global Challenges with the International Network4Sustainable Nanotechnology."
[68] Pokrajac et al., "Nanotechnology for a Sustainable Future: Addressing Global Challenges with the International Network4Sustainable Nanotechnology."

Case Study: Supporting Nanotechnology in LDCs

Many countries fund nanotechnology initiatives, but there is a lacking centralized focus on the SDGs. In 2005, a proposal was made for an initiative called "Addressing Global Challenges Using Nanotechnology", modelled after The Bill and Melinda Gates Foundation's Grand Challenges in Global Health. The intention is to direct individual investigators towards specific problems, trying to achieve breakthroughs on bottleneck issues. Funding and support would come from national, international, as well as public-private partnerships.[69] Through this style of collaboration, global support from many different countries can be aggregated towards the SDGs.

Case Study: Nanotechnology in Medicine

Nanomedicine and the delivery of drugs via products containing nanomaterials has been revolutionary. Nanomaterials can be used to diagnose, monitor, prevent and treat diseases. This revolution has not been without controversy. The small size prevents some safety concerns, with unknowns over how the nanoformulation affects the pharmacokinetics of a drug.[70] Meaning, it is unsure how the microscopic nature of the delivery impacts how the drug is absorbed, distributed, or eliminated in the body. The combination of biological and non-biological products in the body also requires a degree of regulation, in order to classify such products.

As of now, there are not any universally accepted definitions, protocols, method for evaluating nanomedicines nor processing for controlling products, despite their current applications in chronic and acute conditions. In addition, regulation will become more challenging as research advances into more sophisticated areas, requiring firmer definitions and procedures in determining efficacy and safety. Creating an expert group on nanomedicine will be essential, whether this group be national, continental, or global, in establishing recommendations to "guide development and approval".[71] Harmonization of these guidelines is one additional concern, allowing for a common understanding amongst different groups of stakeholders to "support rational decisions pertaining to scientific and regulatory aspects, financing and market access".[72]

[69] Fabio Salamanca-Buentello et al., "Nanotechnology and the Developing World."
[70] Sara Silva Soares, João Sousa, and Alberto a. C. C. Pais, "Nanomedicine: Principles, Properties, and Regulatory Issues," Frontiers in Chemistry 6 (August 20, 2018), https://doi.org/10.3389/fchem.2018.00360.
[71] Ibid.
[72] Ibid.

2.3 - Cell Therapy

Cell therapy is a subset of regenerative medicine that replaces diseased cells with healthy cells, or removes the diseased cells with immune cells. Cell therapy research involves gene editing, protein engineering, and cell culturing.[73] One example of emerging cell therapy is in CAR T Cell therapy in cancer treatment. Instead of surgery, chemotherapy, radiation therapy for tumor removal/reduction, or drug treatment, immunotherapy has emerged as the "fifth pillar" of cancer treatment.[74] Immunotherapy utilizes the body's immune system to attack tumors. In the case of CAR T-cell therapy,[75] a patient's T-cells are extracted from blood, and modified to bind to the patient's cancer cells. The T cells receive a special protein called a chimeric antigen receptor (CAR), thus making the transformed T cell a "CAR T cell". In 2017, the FDA approved 6 of these CAR T-cell therapies for the treatment of some blood cancers, but these therapies have a high cost, with less than half of a long term survival chance.[76] The personalization of a CAR T-cell treatment represents a trend in science to develop specific treatments with a lower chance of rejection. The drawback, however, is the cost of a personalized treatment, and difficulties with large scale deployment as a result.

Case Study: Regulation of Stem Cells and Cloning

Another promising field of regenerative medicine is stem cell research and therapy. The UN also has a unique stance on the usage of stem cells, demarcating usage in therapeutics from research. A stem cell is a special type of cell that has the ability to become other types of human tissues. Research has explored the therapeutic benefit of stem cell treatment, including neurodegenerative diseases, bone diseases, immune diseases and cancer. Due to the controversy of embryonic and embryo-derived stem cells, different nations maintain different stances on the ethical usage of these cells.[77] In a similar line of research as stem cells, the cloning of organisms has also generated debate.

[73] "Harnessing the Power of Cell Therapy - AstraZeneca," April 27, 2023, https://www.astrazeneca.com/r-d/next-generation-therapeutics/cell-therapies.html.
[74] "CAR T Cells: Engineering Immune Cells to Treat Cancer," National Cancer Institute, March 10, 2022, https://www.cancer.gov/about-cancer/treatment/research/car-t-cells.
[75] "NCI Dictionary of Cancer Terms," National Cancer Institute, n.d., https://www.cancer.gov/publications/dictionaries/cancer-terms/def/car-t-cell-therapy/.
[76] "CAR T Cells: Engineering Immune Cells to Treat Cancer."
[77] International Bioethics Committee, Alexander McCall Smith, and Michel Revel. "The Use of Embryonic Stem Cells in Therapeutic Research: Report of the IBC on the Ethical Aspects of Human Embryonic Stem Cell Research." UNESCO Digital Library, 2001. Accessed November 16, 2023. https://unesdoc.unesco.org/ark:/48223/pf0000132287.

Most countries have banned reproductive cloning, with some countries having banned therapeutic cloning, or the cloning for medical treatments. Most cloning laws ban somatic cell nuclear transfer, without banning newer methods for generating organisms, but this is not universal.This debate highlights the need for global governance as a framework based on knowledge sharing and feasibility testing rather than interest based bargaining.[78] Following Dolly the Sheep in 1996, the UN created UNESCO's 1997 Universal Declaration on the Human Genome and Human rights, which was then converted into a non-binding declaration at the request of France and Germany in 2005 as the United Nations Declaration on Human Cloning.[79] This declaration was the product of debate on endorsing therapeutic and research cloning. The result was an ambiguous stance to "prohibit all forms of human cloning inasmuch as they are incompatible with human dignity and the protection of human life,"[80] too weak to discourage rogue research nor promote scientific advancement.[81]

A few issues arise with the banning of any advancing technology. For one, the specificity of laws often refer to what has already been identified as possible, and newer technologies are not covered.[82] The EU produced a Charter of Fundamental Human Rights, which was only ratified by only 23/47 member states. The EU Charter and UNESCO's declarations face the issue of being non-binding, and do not force an absolute ban.[83] In regards to the declaration, interest-based bargaining appears to be ineffective with too many interests, producing vague wording, the avoidance of controversial issues, and lacking consensus.[84]

As such, with cloning and embryonic stem cells banned, research pivoted to induced pluripotency stem cells (iPSC) for therapeutic and research usage in regenerative medicine. iPSC circumvents the ethical dilemma of the human embryo. Instead of harvesting the cells, adult cell are reprogrammed into a stem cell, and then exposed to different factors, resulting in a new cell type.[85] These cells also represent a method of replacing diseased cells, which have a very low chance of rejection by the patient's immune system. This replacement is highly promising in degenerative diseases, like Parkinson's or Alzheimer's. For example, in retinal degeneration, sight is slowly lost, but can be restored with new cells. Stem cell therapy does still have its issues, however. First, the integration of stem cells into the host body's structures, once delivered, is not guaranteed.[86] Second, many clinical trials have only been used in animals. The development of new treatments is a long and resource-intensive process, with many administrative and deployment hurdles to tackle.

[78] Adèle Langlois, "The Global Governance of Human Cloning: The Case of UNESCO," Palgrave Communications 3, no. 1 (March 21, 2017), https://doi.org/10.1057/palcomms.2017.19.
[79] Ibid.
[80] Ibid.
[81] Rosario Isasi and George J. Annas, "To Clone Alone: The United Nations Human Cloning Declaration," Development 49, no. 4 (November 26, 2006): 60–67, https://doi.org/10.1057/palgrave.development.1100313.
[82] Langlois, "The Global Governance of Human Cloning: The Case of UNESCO."
[83] "EU Charter of Fundamental Rights," European Commission, n.d., https://commission.europa.eu/aid-development-cooperation-fundamental-rights/your-rights-eu/eu-charter-fundamental-rights_en.
[84] Harald Schmidt, "Whose Dignity? Resolving Ambiguities in the Scope of 'Human Dignity' in the Universal Declaration on Bioethics and Human Rights," Journal of Medical Ethics 33, no. 10 (October 1, 2007): 578–84, https://doi.org/10.1136/jme.2006.017699.
[85] Mourad a. M. Aboul-Soud, Alhusain J. Alzahrani, and Amer F. Mahmoud, "Induced Pluripotent Stem Cells (IPSCs)—Roles in Regenerative Therapies, Disease Modelling and Drug Screening," Cells 10, no. 9 (September 5, 2021): 2319, https://doi.org/10.3390/cells10092319.

Case Study: Information Integrity

Related to stem cell treatments, globally, there is an industry for selling unproven stem cell interventions directly to consumers, with little scientific support. This industry harms legitimate research efforts towards stem cell treatments, and has caused many adverse effects.[87] Although there are more of these fraudulent clinics based in countries with more lax regulation over drugs and medical treatments, more have appeared in countries with robust regulatory frameworks, representing a $2.4 billion US dollar industry.[88] Seekers of treatment often become afflicted with neurological or cardiovascular complications, infections, and death.[89]

The drive for seekers of unproven medical treatments is good marketing, appealing to belief in regenerative medicine. As a result of the existence of rogue treatments, trust in government institutions decreases, and belief in legitimate regenerative interventions decreases as well.[90] In 2017, the Food and Drug Administration in the United States attempted to tackle the unproven stem cell intervention market by revising guidelines. The new guidelines defined cell-based therapies and manipulations of cells as a regulated procedure, like a drug.[91] The FDA also requested the Department of justice act against unproven stem cell businesses, in efforts to improve oversight of this industry.[92] However, these cases take time to resolve, and enforcement has limited capacity in terms of time and manpower to discontinue these businesses. In addition to cracking down on harmful treatments, misleading/false advertising can also be included in regulatory oversight. For example, the FTC charged one clinic in 2018 for making deceptive claims.[93] While this limited action curbs damages, oftentimes after closing in one nation, the clinic will move to the Middle East, Caribbean or Eastern Europe. Evidently, to most effectively lower the negative impact of these unproven treatments, an international regulatory approach may be necessary to address the proliferation of these clinics.

[87] Gerhard Bauer, Magdi Elsallab, and Mohamed Abou-El-Enein, "Concise Review: A Comprehensive Analysis of Reported Adverse Events in Patients Receiving Unproven Stem Cell-Based Interventions," Stem Cells Translational Medicine 7, no. 9 (n.d.): 676–85, https://doi.org/10.1002/sctm.17-0282.
[88] Zubin Master, Kirstin R.W. Matthews, and Mohamed Abou-El-Enein, "Unproven Stem Cell Interventions: A Global Public Health Problem Requiring Global Deliberation," Stem Cell Reports 16, no. 6 (June 1, 2021): 1435–45, https://doi.org/10.1016/j.stemcr.2021.05.004.
[89] Bauer, Elsallab, and Abou-El-Enein, "Concise Review: A Comprehensive Analysis of Reported Adverse Events in Patients Receiving Unproven Stem Cell-Based Interventions."
[90] Master, Matthews, and Abou-El-Enein, "Unproven Stem Cell Interventions: A Global Public Health Problem Requiring Global Deliberation."
[91] "Regulatory Considerations for Human Cells, Tissues, and Cellular and Tissue-Based Products: Minimal Manipulation and Homologous Use; Guidance for Industry and Food and Drug Administration Staff; Availability," Federal Register, November 17, 2017, https://www.federalregister.gov/documents/2017/11/17/2017-24838/regulatory-considerations-for-human-cells-tissues-and-cellular-and-tissue-based-products-minimal.
[92] "FDA's Framework for Regulating Regenerative Medicine Will Improve Oversight," Pew Charitable Trusts, October 2019, https://www.pewtrusts.org/-/media/assets/2019/10/fdasframeworkforregulatingregenerativemedicine_v2.pdf.
[93] "FTC Stops Deceptive Health Claims by a Stem Cell Therapy Clinic," Federal Trade Commission, September 18, 2021, https://www.ftc.gov/news-events/news/press-releases/2018/10/ftc-stops-deceptive-health-claims-stem-cell-therapy-clinic.

International organizations do exist to harmonize efforts. The World Health Organization, for one, coordinates activities related to international public health.[94] In 2018, in reaction to the genetic modification of a human embryo in China, the WHO established an expert panel on human genome editing. The WHO Expert Advisory Committee (EAC) was to develop global standards for the governance of human genome editing, charged with reviewing current literature, considering current and future frameworks for governance, and exploring public opinion on human genome editing.[95] Some topics for discussion include standardizing definitions, requirements for scientific data on the safety of cell-based therapies, protection of participants in clinical trials, and how to inform the patients/doctors in an area where misinformation runs rampant.[96] Although the WHO is a global organization, it does not have the power to impose health policy or enforce its recommendations. It is able to provide frameworks, as evidenced by the eradication of smallpox, and the reduction of the spread of infectious diseases like TB. Overall, it can be seen that developing technology related to life provides challenges. Different perspectives on regulatory debate delay the speed at which public safety can be ensured. Limitations exist on how far or how seriously an organization can enforce the recommendations it puts forth, but the support of the judicial system with the recommending authorities will accelerate the execution of new regulations.

[94] Jennifer Prah Ruger and Derek Yach, "The Global Role of the World Health Organization.," PubMed, April 1, 2009, https://pubmed.ncbi.nlm.nih.gov/24729827.
[95] Health Ethics & Governance, "WHO Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing: Report of the Second Meeting," September 16, 2019, https://www.who.int/publications/i/item/WHO-SCI-RFH-2019-02.
[96] Master, Matthews, and Abou-El-Enein, "Unproven Stem Cell Interventions: A Global Public Health Problem Requiring Global Deliberation."

2.4 - Genetically Modified Organisms (GMOs)

The modification of an organism utilizes genetic technologies to manipulate cells, seeds, insects, plants and animals, changing food production and with the potential to improve nutrition.[97] Using CRISPR, GMOs can be made to be more resilient to adverse weather and pests, while being more nutritious. For example, the International Rice Research Institute created more than 150 stress-tolerant strains of rice across 10 years of development, delivered to 18 million farmers across Africa and Asia.[98] GMOs have also been adopted in countries like the US, where more than 80% of planted acres are genetically modified crops, accounting for 40% of global GMO planted land. Of concern, despite all the benefits, is the cost to production that GMOs add, and the inequity of GMO distributions. Since GMO seeds generally grow better, it is one concern that power in the market concentrates to a few large-scale GMO crop companies/users, leaving small farmers to grow increasingly disadvantaged, paying more for crops that they need to use to be competitive.[99] In a Canadian court case, a farmer was using genetically modified seeds from a company called Monsanto. The company copyrighted, and therefore had ownership, over the genetic sequence of the modified seeds, so when the farmer used the seeds without a licence, they were found to be infringing on the ownership over the modified seeds.[100]

In another issue of inequitable access, gene therapies attempt to change the genome of a diseased cell to not be diseased anymore. While cutting-edge medicine, the cost of treatment for rare diseases ranges from $373 000 and $1 million.[101] In addition to this cost barrier, there is a research divide, predominantly profit-driven. Research and development differs between countries, but prioritization generally falls onto the more profitable disease markets. According to the WHO, only 10% of research worldwide goes towards 90% of the world's population, with a fraction of new drugs intended for tropical diseases.[102] Lastly, ethical issues persist even outside of human genomics. When modifying a population of organisms, the modification persists beyond the first generation. A genetic change will persist in the germ line of the population, meaning a small change meant to combat a disease, say malaria in mosquitoes, may uncontrollably proliferate and cause unintended ecological damages. If mosquitoes become sterile, and the population decreases, predators may lose a food source, causing unpredictable ripple effects.

[97] "Playing with Genes: The Good, the Bad and the Ugly," Frontier Technology Quarterly, May 2019, https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/FTQ_May_2019.pdf.
[98] "STRASA Legacy Site - About Us," n.d., https://strasa.irri.org/home.
[99] "Playing with Genes: The Good, the Bad and the Ugly."
[100] "STRASA Legacy Site - About Us," n.d., https://strasa.irri.org/home.
[101] "Playing with Genes: The Good, the Bad and the Ugly."
[102] Ibid.

Case Study: Privacy Concerns and Consent

In genomic research, there is currently ongoing debate over the publication of DNA sequences. This sequence is unique to a person, creating difficulties in anonymizing data. However, without the open data approach to genomics agreed upon in 1996 by scientists, [103] the advances to human genomics research would not have occurred as rapidly. The same argument can be applied to the usage of Henrietta Lacks' immortal cells (HeLa cells) in research, but this usage is far more controversial, as there was no prior agreement for the usage of the cells, nor the release of the HeLa cell DNA sequence.[104]

Similar to the moratorium on AI development, in 2019, eighteen scientists and ethicists from seven different countries called for a moratorium on germline editing.[105] The purpose of this temporary ban was to allow time to establish an international framework for allowing ethical uses of clinical germline editing. With issues such as off-target editing, and non-intended effects from changing merely one gene, the scientists felt that the clinical application of gene editing was not ready for deployment. There was a need for more regulatory development on appropriate uses and safety standards before the world was ready.

As the cost of genetic technology decreases and reaches the consumer market, regulation and policy regarding quality control, responsible data use, and confidentiality of data are required, as well as resolving the issue of intellectual property. For example, commercialized genetic testing has increased through services like 23andMe. Contrasting the scientific community's stance on open-data, the commercial side of genetic sequencing takes an opt-in approach. However, this are still confidentiality concerns over violating the "right not to know" in revealing previously unknown related individuals, and hidden disease risks resulting in increasing insurance rate premiums. Some services do allow the individual ownership of the test, by giving the buyer their sequence directly, without any company analysis.[106]

[103] Wikipedia contributors, "Bermuda Principles," Wikipedia, May 5, 2023, https://en.wikipedia.org/wiki/Bermuda_Principles.
[104] "Playing with Genes: The Good, the Bad and the Ugly."
[105] Eric S. Lander et al., "Adopt a Moratorium on Heritable Genome Editing," Nature 567, no. 7747 (March 1, 2019): 165–68, https://doi.org/10.1038/d41586-019-00726-5.
[106] SITNFlash, "Understanding Ownership and Privacy of Genetic Data - Science in the News," Science in the News, November 28, 2018, https://sitn.hms.harvard.edu/flash/2018/understanding-ownership-privacy-genetic-data/.

Case Study: Food Industry

The UN has identified genetic modification of crops to be a potential solution, with better harvests and stronger survival of crops. Golden rice serves as an example for combating malnutrition, as over 140 million children are deficient in vitamin A. This deficiency leads to blindness and death. This strain has the greatest potential for combating malnutrition precisely because the patent rights were waived.[107] However, whether or not the lack of a copyright will incentivize distribution of this crop has yet to be seen. The US and Canada approved golden rice in 2018.[108] The Phillipines followed this decision in 2018, and permitted the commercial farming of this rice in 2021. However, this permission was retracted in 2023 after the Supreme Court,[109] once again demonstrating how despite the goal of resolving malnutrition in developing nations, the majority of GMO use is within developed nations.

As a historical footnote, a similar approach to parenting was taken by Banting and Best, the first scientists to isolate insulin and successfully treat diabetic children. They patented the process for synthesizing artificial insulin for $1.00 so nobody else could patent it, and made the knowledge free so no one party could dominate the market.[110] This action was seen as a step forward in medical ethics, ensuring accessibility and affordability of a life-saving drug.[111]

Improved crop yields with GMO would greatly support the fight against malnutrition. On the other hand, critics have suggested that previously mentioned inequities in GMOs is too large of a problem, and instead, nations should be trying to source nutrition from local produce. The view is that there would be no need to introduce an entirely new strain of crop, if a local crop could be cultivated for local consumption, or for sale on the global market.

In addition, modified crops may fail to germinate as a result of the modifications to their genome, overpower and kill native plants, reduce soil fertility, and transfer resistance to other plants. Examining these issues, perhaps the resolution of global hunger requires more than new biotechnological solutions. Perhaps classic political solutions are required to adjust the distribution of pre-existing resources, instead of relying on the unproven and risky implementation of scientific breakthroughs. For example, if pesticide resistance is an issue, two interesting suggestions are the rotation of blight-resistant crops with non-resistant crops, or on a higher regulatory level, regulating improper usage of herbicides instead of introducing more herbicide-resistant crops.[112]

[107] "Playing with Genes: The Good, the Bad and the Ugly."
[108] Christopher Gonzales, "Filipinos Soon to Plant and Eat Golden Rice," Philippine Rice Research Institute, January 27, 2022, https://www.philrice.gov.ph/filipinos-soon-to-plant-and-eat-golden-rice/.
[109] Neil, "SC Issues Writ of Kalikasan vs Golden Rice, Bt Eggplant," BusinessWorld Online, April 19, 2023, https://web.archive.org/web/20230420164928/https://www.bworldonline.com/top-stories/2023/04/20/517938/sc-issues-writ-of-kalikasan-vs-golden-rice-bt-eggplant/.
[110] Wikipedia contributors, "Insulin - Wikipedia," November 1, 2023, https://en.wikipedia.org/wiki/Insulin.
[111] "Copy of the Article: A Step Forward in Medical Ethics | The Discovery and Early Development of Insulin," n.d., https://insulin.library.utoronto.ca/islandora/object/insulin%3AW10031.
[112] Mark Cantley, "An Overview of Regulatory Tools and Frameworks for Modern Biotechnology: A Focus on Agro-Food," OECD International Futures Project, February 2007, https://www.oecd.org/futures/long-termtechnologicalsocietalchallenges/40926623.pdf.

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